Occupational Injury and Illness Surveillance: Conceptual Filters Explain Underreporting

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Abstract

Occupational health surveillance data are key to effective intervention. However, the US Bureau of Labor Statistics survey significantly underestimates the incidence of work-related injuries and illnesses. Researchers supplement these statistics with data from other systems not designed for surveillance.

The authors apply the filter model of Webb et al. to underreporting by the Bureau of Labor Statistics, workers' compensation wage-replacement documents, physician reporting systems, and medical records of treatment charged to workers' compensation. Mechanisms are described for the loss of cases at successive steps of documentation. Empirical findings indicate that workers repeatedly risk adverse consequences for attempting to complete these steps, while systems for ensuring their completion are weak or absent.

The United States does not have a comprehensive national surveillance system for occupational injuries and illnesses. Lacking this system, major sources of US occupational health data include the Bureau of Labor Statistics (BLS) annual survey of occupational injuries and illnesses, workers' compensation records, and physician reporting systems. Data produced by these systems have been described as fragmentary, unreliable, and inconsistent. Moreover, they have been shown to underestimate the incidence of workrelated injuries, illnesses, and even fatalities by as much as several hundred percent.[1–13]

Following a 1987 National Academy of Sciences report on the shortcomings of surveillance systems,[9] the BLS redesigned its annual survey[10,14] and introduced new programs to improve documentation of occupational fatalities.[15] However, the problem of underreporting remains unresolved.

Here we adapt the filter model developed by Webb et al.[16,17] to describe the documentation of work-related injuries and illnesses in Australia. Filter models are applied to the BLS and physician-based surveillance systems. Because data from other systems not designed for surveillance are nonetheless used to inform research and public policy, the discussion includes workers' compensation wagereplacement data and medical records. This last source provides data to individual research projects as well as the National Hospital Ambulatory Medical Care Survey and related programs.[18]

SEQUENCES OF EVENTS IN FILTER MODELS

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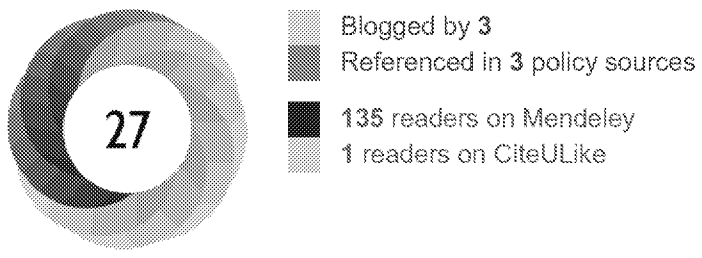

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Documentation of work-related injuries and illnesses involves complex series of events. Webb et al. used the term "filter" to characterize partial barriers to these events. They explained that "unless the filters are totally permeable, the injuries detected at successive levels will be fewer and more severe"[16(p116)] and also more visible. Factors related to the individual, the immediate work environment, and the larger economic, legislative, and social contexts may also affect permeability.[16–17,19]

Filter models adapted from Webb et al. for US systems might include these steps (clinical steps abstracted from Lax[20]):

1. Bureau of Labor Statistics

   Private employer pays employees according to legal processes. Event occurs on shop floor. →Worker perceives that he or she is injured or sick. →Worker perceives workrelatedness of illness or injury. →Worker perceives desirability of reporting injury or illness to supervisor. →Worker reports injury or illness to supervisor. →Supervisor perceives that the worker has a legitimate work-related health problem. →Supervisor allows worker to take a full day away from work or provides restricted work *or* worker perceives means to pay for medical treatment, obtains medical treatment, and informs the supervisor. →Supervisor logs the injury according to Occupational Safety and Health Administration (OSHA) record-keeping requirements. →Log is sampled by BLS survey.

2. Massachusetts Workers' Compensation, Department of Industrial Accidents

   Event occurs on shop floor. →Worker perceives that he or she is injured or sick. →Worker obtains medical care. →Physician accurately diagnoses condition. →Physician takes occupational history *or* worker perceives the work relatedness of the condition and informs physician. →Physician demonstrates link between workplace exposure and health problem. →Physician determines that worker is effectively disabled from working for 5 or more calendar days. →Employer, employee, or insurer files first report with the Department of Industrial Accidents.

3. Medical Records

   Event occurs on shop floor. →Worker perceives that he or she is injured or sick. →Worker reports problem to supervisor, who understands that the worker has a workrelated injury and reports it to the employer's workers' compensation insurer *or* the employee perceives the work-relatedness of the condition and contacts the insurer to obtain the claim number *or* worker has other means of paying for medical care. →Worker obtains medical care at a hospital or clinic that accepts workers' compensation. →Physician accurately diagnoses the condition. →Physician takes occupational history *or* worker perceives the work relatedness of the condition and informs physician. →Physician demonstrates link between workplace exposure and health problem. →Hospital or clinic charges workers' compensation for the treatment.

4. Physician Reporting Systems

   Event occurs on shop floor. →Worker perceives that he or she is injured or sick. →Worker has access to medical care. →Worker obtains medical care. →Physician accurately diagnoses the condition. →Physician takes occupational history. →Physician recognizes condition as work related. →Illness or injury is reportable in the state where it occurs. →Physician is aware of the reporting system. →Physician reports the case as required.

THE FILTERS IN DETAIL

Section: Choose

Figure 1 shows the sequences of events necessary to the capture of a work-related health problem by each of the 4 data sources. Each event is preceded by a filter symbolized by a dotted line and labeled with a lowercase letter. The filters are described in detail below.

a. Filters to Reporting to Supervisors

Workers who report health problems to supervisors may risk disciplinary action, denial of overtime or promotion opportunities, stigmatization, drug testing, harassment, or job loss. Others may fear such outcomes even in the absence of demonstrable risk. Some safety incentive systems reward workers who do not report injuries with money, material goods, or recognition.[8–9,19–25]

Members of active unions may have support for safely reporting health problems. Workers with insecure immigration status, limited permission to work, or lack of marketable job skills are particularly vulnerable to the dangers of reporting. Low-wage and immigrant workers are especially likely to be fired or threatened for complaining.[26–33]

Contingent workers, including temporary employees and most construction workers, may risk future job assignments by reporting health problems.[34] Workers kept in the "outside ring" of temporary or on-call employees maintained by large companies may lose their potential for permanent employment with the company.[35]

Pransky et al. found that more than 85% of 98 employees in several industrial facilities were experiencing work-related illness or injuries, almost 50% had work-related problems that lasted through the week, and 30% had lost time or faced work restrictions because of these problems. Yet fewer than 5% of the workers had officially reported a work-related health problem. Reasons given for not reporting included fear of discipline or of being labeled a complainer. Additional barriers to reporting included a company goal of no reported injuries, reinforced by the presence of incentive programs that rewarded low levels of reported injuries.[11]

Surveys collected from 372 environmental service workers in Baltimore hospitals in 1993 showed that 42 (39%) of the 108 workers injured in the previous year had not reported one or more injuries. The most common explanations included not wanting the supervisor to think the worker was careless and considering the injury too minor to report. Yet 64% of 45 responses stated the injuries required medical care, and 44% of 34 responses indicated resulting lost work time.[13]

A survey of 55 emergency department nurses showed that 56% had been assaulted in the previous year, but 29% of the assaults were unreported. Reasons for not reporting included the belief that assaults "go with the job" and that reporting them would not be helpful.[36]

b. Filters to Lost Work Time Due to Work-Related Illness and Injuries

Workers who do inform their supervisors of an injury or illness may not be able to afford lost work time. Workers' compensation partial wage replacement becomes available only after a minimum number of lost workdays. The compensation pays for only a portion of lost wages, often does not cover the first several days lost, usually takes several weeks to arrive, and may be contested or denied altogether.[20,37–43]

Workers who are aware of these obstacles or who are unfamiliar with wage replacement benefits may depend on paid sick time to recover from workplace injuries or illnesses. Thus, lack of sick leave benefits, especially common in nonunion employment, may prevent these workers from missing work. Losing work time from low-wage, temporary, or contingent employment can result in immediate poverty or job loss, effectively preventing certain populations (e.g., the 47% of immigrants arriving in Massachusetts since 1990 who live in families with total incomes less than $20 000[44]) from passing through this filter. Missing work can also place employees at increased risk for layoffs and decreased opportunities for overtime and promotions.

Certain illnesses do not prevent the ability to continue to work, although the work may exacerbate the illness.[4] Alternatively, employers can avoid lost time by providing light duty. Thus, injuries resulting in lost time may not represent underlying patterns.[16]

Jefferson and McGrath found that 28.4% of 306 employees of an aircraft engine plant reported lower back pain sufficiently severe to interfere with their daily activities, and 27% of the workforce had been seen at the plant clinic for lower back pain within the previous year. However, during that year only 2.3% of the workers lost work time due to low back pain.[45]

c. Filters to Medical Care for Work-Related Injuries and Illnesses

Some companies provide care for work-related musculoskeletal disorders (MSDs) and other injuries in-house, providing splints, ice, exercise, anti-inflammatory medication, and other

treatments defined as "first aid" (Michael Lax, MD [LaxM@upstate.edu], e-mail, November 2001). Workers who develop diseases without easily recognized symptoms or with long latency periods are not likely to recognize that they are sick, or sick enough to require care. Workers who do realize they require medical care may nonetheless forgo treatment because they are not able to pay for the care and do not expect their health costs to be covered by workers' compensation. They may not rely on workers' compensation because they fail to perceive the work relatedness of their condition; anticipate difficulty in demonstrating the work relatedness; assume, incorrectly, that having a job without benefits excludes them from this system; assume, incorrectly, that incomplete employment or immigration documentation excludes them; or assume, correctly, that obtaining this coverage can be difficult and costly.[8,38,39] Other workers are entirely unfamiliar with workers' compensation.

Workers who do not expect their condition to be covered by workers' compensation may forgo medical care owing to lack of access to or familiarity with alternative methods of payment. Morse et al. found that Connecticut workers with likely work-related MSDs who had no health insurance were one third as likely as insured workers to see a physician and to have their condition diagnosed as work-related.[19] Yet approximately 43 million residents of the United States, and nearly half of poor workers, do not have health insurance.[46] Nearly 1 in 5 low-income adult US citizens report having no usual source of medical care.[47]

Workers with insurance may be unable to obtain coverage for medical treatment because their regular health coverage classifies their conditions as work related while the workers' compensation system maintains that they are not.[40,48]

Some workers have no time to seek care. Of 790 low-wage and immigrant workers surveyed by 12 community-based organizations in Chicago, 30% were not allowed to take sick or vacation days, paid or unpaid, without risk of being fired. Subjects of this study were likely to enjoy better working conditions than many immigrant workers, since 85% were legal permanent residents or US citizens.[49]

d. Filters to Recognition of Work-Related Injuries and Illnesses

Workers who obtain medical care may not perceive a connection between their health problems and their jobs, a problem reinforced by lack of hazard communication at the worksite. Clinicians may also fail to recognize work relatedness. Most US physicians receive little or no training about occupational illness.[6,50,51] For the 68% of 115 US medical schools studied that reported teaching occupational health to their students in 1991, the median curriculum time devoted to the subject was 6 hours.[52]

Immigrant workers who do succeed in obtaining medical treatment may find that language barriers and misdiagnosis prevent them from receiving appropriate treatment and identification of work relatedness.[28,29,47,53–55]

Lack of recognition is especially likely for diseases with long latency periods, symptoms common to nonoccupational disorders, or multiple causal factors. These include nonpneumoconiotic chronic respiratory illness, cancer, heart disease, renal disease, and neurological disorders.[3,5,6,15,50,56–62] Almost two thirds of occupational diseases reported by California physicians during selected periods in the 1980s were skin and eye problems, while almost no occupational cancers were reported.[8]

Milton et al. examined 67 complete medical charts for Massachusetts patients with new-onset and reactivated cases of asthma, 14 of which were work-related. None of the 67 patients had been referred to occupational medicine clinicians; 7% had been asked about occupational triggers by primary and urgent care physicians and 15% by any clinician; none had been reported to the Sentinel Event Notification System for Occupational Risks (SENSOR) physician reporting system; and none had treatment charged to workers' compensation. Of the 14 patients with occupational asthma, 2 had been asked about their jobs by their physicians, and none was noted by treating physicians to exhibit work-related symptoms.[63]

e. Filters to Charging Medical Care to Workers' Compensation

Obstacles to workers' compensation at the levels of employers, clinicians, and workers have been reviewed extensively.[20,38–41] Filing compensation claims can raise employers' premiums, while charging ordinary health insurance coverage usually does not. Employers typically pay all

compensation insurance costs with no co-payments by employees.[42,64–66] In the construction industry, contractors' records of compensation claims also affect their competitiveness in contract bids.[64]

As a result, some employers warn their employees not to tell their doctors that they were hurt at work. Some maintain medical professionals on staff, or train nonclinician staff to treat injured employees, and cover the costs. Some employers, like the 13% of a 1997 sample of Florida businesses, fail to carry workers' compensation coverage although they are required to by law.[40]

Workers may choose to avoid the compensation system because it may not cover all necessary medical treatment. Compensation insurers sometimes deny medical coverage for work-related conditions or contest coverage for several years. Such delays particularly affect immigrant workers, who may face greater language, cultural, legal, and bureaucratic barriers than those born in the United States.[67] Compensation may be denied, and is typically contested, for health problems with multiple potential causes or long latency periods.[20,68] Charges to workers' compensation may also lead to job loss, difficulties in obtaining future employment, and social stigma for the patient.[9,38,39,69,70]

Self-employed workers are not covered by workers' compensation.

Many employers, workers, and clinicians are simply not familiar with the compensation system.[64] Some clinicians may not understand the questions asked by the compensation system or appreciate the importance of compensation for injured workers. Others prefer to avoid the additional paperwork, delays in reimbursement, nonpayment, low fee schedules, and complications of interacting with patients' employers.[51,56,61]

Jobs that provide medical insurance, disproportionately common in professional and unionized employment, may decrease the permeability of this filter, especially for people familiar with the challenges described above. Conversely, Frumkin et al. have argued that hospitals have a strong incentive to obtain workers' compensation coverage for underinsured and uninsured patients.[71]

Herbert et al. studied 135 patients diagnosed with work-related carpal tunnel syndrome. Of these patients' workers' compensation claims, 79% were initially challenged or received no response from insurers. Claims adjudication took an average of 429 days (range, 58–1617 days). Authorization for surgery following a physician's request took an average of 318 days (range, 7–595 days). Insurers were significantly more likely to challenge claims filed by non-Whites, low-wage workers, and union members.[72]

Rosenman et al. interviewed 1598 mostly unionized automobile workers diagnosed with known or suspected occupational repetitive trauma, of whom 1582 reported whether they had filed a workers' compensation claim. Of these, 397 workers (25.1%) had filed a claim. Of the 397 who filed, 54 (13.6%) did not receive coverage for medical costs. Of the 1185 who did not file, 427 (36.0%) reported that their medical expenses were covered by other insurance, and 242 (20.4%) believed their injury was not work-related. Workers who consulted a specialist were approximately 8 times more likely to file for compensation than those who only visited the company doctor.[73]

Morse et al. interviewed 292 Connecticut residents with work-related MSDs. The sum of the numbers of practitioners or specialists visited by these subjects for these conditions during the previous 2 weeks was 722. Source of payment was specified for 672. Of these, 139 (20.7%) were reportedly covered by workers' compensation. Another 478 (71.1%) were paid by general health insurance, and 55 (8.2%) by the patients. Of respondents seen by a general practitioner or a family doctor, 10.9% and 12.2%, respectively, reported coverage by workers' compensation.[65]

Waller et al. studied carpenters treated for work-related injuries at a Vermont hospital in 1986 and 1987. Of 168 non–self-employed subjects, 62 (37%) had their hospital bills covered by workers' compensation. Various forms of health insurance covered 32% of the bills and Medicaid covered 2%. Patients themselves paid 17%.[74]

Sorock et al. interviewed 134 former New Jersey hospital patients treated for finger or thumb amputations described as workrelated. Of these, 25 (19%) were not coded "workers' compensation" in the discharge database. Thirteen of these 25 patients were self-employed and so were not covered by workers' compensation. Thus, the costs of 12 (9.0%) of the 134 patients were apparently incorrectly charged to a non–workers' compensation payment source.[75]

f. Filters to Recording Incidents in OSHA Logs

In 1987 the National Academy of Sciences found that several of the largest corporations in the United States engaged in serious and willful underreporting of work-related injuries. Reasons included the desire to avoid OSHA inspections as well as competition among companies and among plants within a company to record low injury rates and enhance supervisors' performance evaluations.[9] During certain periods eligibility for OSHA voluntary compliance programs or inspection exemptions have depended on low rates of recorded injuries, while enforcement efforts targeted employers with high rates.[9,13,21,76–80]

Conway and Svenson have listed other potential obstacles to proper record keeping:

Sheer neglect for the records, no training for the record-keeper, no emphasis on maintaining records properly, downgrading recordkeeping to a collateral duty of a clerical or support staff person. Poor communications between different departments within the company, with the record-keeper kept uninformed of injuries and illnesses, even when employees have reported them to their supervisors. Management bonuses and opportunities for promotion tied negatively to injury and illness rates.[21(p38)]

Silverstein et al. have explained that differences in management policy and personnel training may lead to large variations in record-keeping practices among firms. Employers may record occupational injuries and illnesses in ways that protect the business from liability, particularly in the identification of the source, causal event, and exposure leading to the injuries.[81]

For example, providing on-site medical treatment and classifying it as first aid circumvents reporting requirements. In 1997 OSHA cited a plastic molding plant where the human resources manager had restricted recordable injuries in the plant to those that required hospitalization, cost more than $200 to treat, or resulted in 3 doctor's appointments.[82,83] An investigation of a plant manufacturing baseball caps revealed that plant managers reduced injuries logged by including new injuries with old injuries in a single report (Michael Lax, MD [LaxM@upstate.edu], e-mail, November 2001).

Oleinick et al. have argued that the relatively low rates of reported injuries in establishments with fewer than 50 employees reflect lax record keeping rather than safer conditions,[84] a position buttressed by the higher fatality rates in smaller companies,[84,85] although others have found that smaller establishments are generally less hazardous.[86]

Of the 790 mostly legally documented low-wage workers surveyed in the Chicago study, 8% reported pay levels below minimum wage, 20% reported not receiving all wages due, 16% reported that taxes were not deducted from their wages, 16% described work in dangerous conditions without protective clothing or training, and 17% said they were required to work overtime but not paid for it.[49] Given such practices, it is reasonable to expect limited adherence to OSHA record-keeping requirements.

Injuries and illnesses affecting home workers, the self-employed, and government employees are excluded from BLS surveys.[69]

For a 1987 study, BLS randomly selected 200 manufacturing establishments with more than 10 employees from 2 states. OSHA compliance officers found that these companies underrecorded total injuries and illnesses by about 10% and lost-workday injury and illness cases by about 25%. OSHA contracted a study that examined more than 250 nonconstruction establishments with over 60 employees in 1998. This study found that total injuries and illnesses were underreported by 11%, and lost-workday cases by 22% to 23%.[21]

Park et al. found that 1984–1987 OSHA logs failed to document between 20% and 80% of occupational cumulative trauma disorders recorded in other data sources for unionized employees of an automobile manufacturer. Reasons for the variation included changes in intensity of enforcement and different practices across plants.[56]

Silverstein et al. found that OSHA logs significantly underreported both the rate and severity of MSDs in a selection of automotive plants with ergonomics programs, despite high levels of unionization, relatively secure employment, and management that acknowledged the importance of preventing these injuries.[81]

McCurdy et al. studied 16 sites involved in the Semiconductor Industry Association's Occupational Health System, large companies with exceptional commitments to health and safety record keeping. Of 416 cases randomly selected from these records, 101 met OSHA reportability criteria, but only 61 (60%) of these were recorded in OSHA logs.[87]

Glazner et al. compared BLS rates for injuries and illnesses in construction to workers' compensation data for the more than 32 000 employees who constructed the Denver International Airport. Total injury rates were at least twice those for comparable industry and company size in BLS data. Rates for very small companies (1–19 employees) were more than 3 times those in BLS data.[64]

Fine et al. found that "incidence rates calculated from medical record data in two of the [three large automobile] plants were 4–5 times greater for acute trauma and 68–93 times greater for cumulative trauma disorders of the upper extremities than those coded from the OSHA 200 log."[88]

Fingar et al., using a combination of emergency department and workers' compensation data for an area of Ohio, estimated worker injury rates 25% higher than those predicted by the BLS.[89]

Behrens et al. noted that the 12-month prevalence for occupational dermatitis estimated through the National Health Interview Survey exceeded by more than 20-fold the annual incidence rates for "occupational skin diseases or disorders" estimated by the BLS.[90]

The Massachusetts Department of Public Health combined workers' compensation wage-replacement cases with physician reports for 5 years and found approximately 2.5 times the number of Massachusetts work-related carpal tunnel syndrome cases estimated by the BLS.[12]

g. Filters to Filing First Reports of Injury to State Workers' Compensation Agencies

Requirements for reporting workers' compensation cases to state agencies vary substantially by state.[7] In Massachusetts, employers are required to file "first reports of injury" with the Department of Industrial Accidents and their insurers when a work-related health problem results in 5 or more lost workdays.[37]

As with medical compensation, employers may avoid filing wage-replacement claims to control their insurance rates. Workers are permitted to file for wage replacement themselves, but they may not know this. Other workers may choose not to file because compensation pays only a portion of lost wages and does not cover other expenses related to the injury. Filing claims can also lead to mistrust by clinicians, employers, coworkers, or family members, especially following media reports of workers who malinger or defraud the system[20,37–43] Salaried workers may see filing claims as an impediment to their careers.[69]

Most states allow insurers to exercise utilization review at their own discretion, resulting in requirements for clinical findings far exceeding those required for nonoccupational conditions. Obtaining wage replacement for work lost due to occupational illnesses such as cumulative trauma or respiratory disorders can be costly, time-consuming, or even impossible because insurers often dispute the work relatedness of the condition or the need to miss work or require assessments by inaccessible clinicians.[41,51,65,91] Physicians who find workers eligible for partial replacement of lost wages must demonstrate not only the disease, but the workplace exposure, the causal connection between the exposure and the disease, and a specific level of disability. This can involve coordinating with other practitioners for special diagnostic testing, assessments of impairment, evaluation of job demands, and determinations of fitness to resume work. Insurers may demand industrial hygiene, toxicological, or epidemiological data that do not exist. Findings are liable to litigation, testimony, further paperwork, and disputes with other physicians.[20,41,51]

Even when employers or employees file for wage replacement with their insurance carriers, they may fail to file the required first report with a state agency. Compliance with reporting requirements is not enforced or even formally monitored.[92] Reports that are filed are typically completed by staff untrained in the coding systems.

Employers who self-insure for workers' compensation are not required to report lost time cases to the state.[4,56]

Morse et al. found that 5.4% of an estimated 14 686 work-related upper-extremity MSD cases in Connecticut for 1995 were reported to the state compensation agency. One year of data from the Connecticut Upper-Extremity Surveillance Project found 25 incident cases, of which 4 had been

reported. Well-defined conditions such as carpal tunnel syndrome were more likely to be documented.[93]

Of 292 likely cases of work-related MSDs identified in a Connecticut telephone survey, 31 workers had filed for workers' compensation. Those with injuries called work related by a physician were more than 13 times as likely to file as others. Other strong predictors for filing included the need for surgery, seriousness of the injury, overall impairment in activities of daily living, need for time off from work, union membership, and the feeling that management did not care about or support the workers.[19]

Of the 1598 mostly unionized automobile workers interviewed by Rosenman et al. diagnosed with known or suspected occupational repetitive trauma, 313 met the Michigan threshold for wage replacement of 7 or more consecutive lost workdays. Of these, 197 (63%) received benefits for wage replacement. Seventy-seven (25%) did not file claims, some because they expected sick leave or short-term disability benefits from their employer.[73]

Biddle et al. examined records for approximately 30 000 Michigan workers who had been reported to the Michigan Department of Public Health as having known or suspected work-related illnesses. They found that at least 54% of these mostly unionized workers did not file for wage replacement benefits, perhaps trying to "tough out" or "work through" the health problem.[94]

Frumkin et al. interviewed 107 of 335 patients treated for work-related injuries during a defined period at local emergency departments in poor, mostly African American areas of Philadelphia, Pa. Of the 107, 34 applied for, and 27 (25%) eventually received, workers' compensation. Only 3 received disability awards, although 42 (39%) reported persistent health problems as a result of their injuries and 75% reported lost work time.[71]

Stanbury et al. studied 177 people with occupational silicosis identified by the New Jersey Department of Public Health between 1979 and 1992. They found that 31% had filed workers' compensation claims for this unambiguously work-related disease, and that 84% of those were awarded payments.[68]

Most Texas workers with recognized occupational disease who were surveyed by the Texas Research and Oversight Council on Workers' Compensation did not file workers' compensation claims, often citing concerns about negative consequences in the workplace. Among those who did file, 44% reported experiencing or being concerned about retaliation at work.[95]

Fingar et al. combined workers' compensation data for 1982 through 1986 in Ohio, where state-insured employers are required to file reports after 1 lost work day, with emergency department data. They found that the workers' compensation system detected 25.5% of the 6173 injuries in the combined data, while emergency department records detected 81.2%.[89]

In a 1994 study of 358 Massachusetts workers' compensation records of probable occupational carpal tunnel syndrome, first reports were available for only 47% of the cases. Sixty percent of the reports lacked industry codes or coded the involved industry as unclassifiable.[92]

h. Filters to Participation in Physician Reporting Systems

As of 1988, at least 33 states had mandatory reporting system programs requiring clinicians to report cases of occupational injury and illness.[62,96] However, physicians have limited relations with public health agencies[61] and few incentives to participate.

Rosenman et al. studied work-related asthma cases in Michigan between 1988 and 1994 and estimated that 0.7% of the approximately 30 000 Michigan physicians required by law to report occupational illness actually did so. Most had never heard of or submitted occupational disease forms.[97] Rosenman et al. concluded:

We attribute the lack of complete reporting to many factors, including: (1) physician lack of awareness of the reporting law, (2) physician lack of awareness that aggravation of asthma from work exposures is a reportable condition, (3) physician antipathy and fear of programs that are perceived to involve governmental or legal hassles, (4) physician lack of familiarity and difficulty with diagnosing occupational diseases in general and work-related asthma specifically, and, (5) physician workload and demands on time for completing multiple record requirements.[97(p424)]

Biddle et al. noted that employees of small companies or those who see their own physicians for work-related disease are largely excluded from the Michigan reporting system, since 90% of the reports are submitted by physicians working for major manufacturing firms.[94]

All physicians in Connecticut are also required to report known and suspected occupational disease to the state Departments of Labor and Public Health, but in 1998 just 96 physicians, mostly from occupational health services, participated.[2] Of upper-extremity work-related MSDs reported to workers' compensation in Connecticut in 1995, 6.7% were reported to the state surveillance system.[93]

Legally mandated physician reports identified only 25% of the 4836 cases of work-related carpal tunnel syndrome documented by the Massachusetts Department of Public Health over 5 years. Just 7% of Massachusetts hand surgeons and 13% of orthopedists reported cases during the study period. Physician-reported cases decreased with time following mailings about reporting requirements.[12]

The California mandatory physician reporting program has been estimated to undercount work-related asthma cases by two thirds, despite the fact that physicians must complete reports to obtain reimbursement from workers' compensation.[98]

i. Filters to Capture of Medical Records Data in Hospital Databases

Even when treatment is correctly charged to workers' compensation, medical records can significantly underestimate overall hospital use[99] or provide incomplete information. For example, the Utah Department of Health is authorized by law to collect emergency department data from all licensed Utah hospitals. Of 87 509 cases in this system meeting study criteria as injured working-age adults in 1996, 16.9% did not have a recorded payer category.[100] Of 1020 cases sampled from the 1993 Massachusetts Cancer Registry, 43% had industry and occupation coded in the medical records. Almost none indicated whether these referred to the patient's usual job.[101]

CONCLUSIONS AND RECOMMENDATIONS

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Surveillance is crucial to the recognition, treatment, and prevention of occupationalinjuries and disease. Identification of workrelated cases can benefit the individuals diagnosed, their immediate coworkers, workers throughout the industry, and people exposed to implicated causal factors in other settings.[65,96,102]

The lack of a comprehensive occupational health data collection system in the United States has led to reliance on piecemeal data sets produced by systems not designed for surveillance. These systems involve obstacles that filter out work-related health problems at each step. Such filters particularly block documentation of health problems affecting populations especially vulnerable to workplace hazards, including immigrant and low-wage workers.[26,103–106] These workers constitute increasing proportions of the US workforce; for example, the percentage of workers of Hispanic origin was 5.7% in 1980 and will grow to a projected 13.3% in 2010.[47,107,108]

The Surveillance Strategic Plan recently developed by the National Institute for Occupational Safety and Health recommends, among other goals, (1) the development of alternative data collection methods for health care institutions, employers, and unions; (2) stronger surveillance of special populations, temporary workers, and contingent workers; and (3) follow-back investigations and focused surveys of high-risk groups to supplement existing data.[109] The analysis presented here strongly supports these goals.

More sensitive data collection will require supplementary approaches, both to identify cases of work-related health problems and to obtain information about associated exposures. These approaches can include routine collection of occupational, demographic, and work environment information by medical reporting systems.[101] Medical data can also supplement additional information sources.[12,43,57,71,110] For example, SENSOR programs combine data from physician reports and hospital discharge data with information from laboratories, clinics, and death certificates.[1,10,62,96] The National Electronic Injury Surveillance System supplements hospital emergency department records with patient interviews.[111,112] Narrative text fields from injury databases combined with hospital data support understanding of hazards, circumstances, and specific injuries not recognizable from medical codes alone.[4] Population-based surveys such as the

National Health Interview Survey can contribute further information when they include items relevant to occupational health.[89,113,114]

Such multiple sources of data should be synthesized systematically, with methods including the capture-recapture approach used by Morse et al.[93]

Data collection by government agencies may not elicit the trust and cooperation of workers with sweatshop or informal jobs, at-risk employment or immigration status, or illegal housing arrangements. Thus, another key approach involves community-based surveys performed by organizations known and trusted by the populations under study.[49,115,116]

A public health approach to occupational health surveillance will require further studies specifically targeting defined populations and designed with consideration of their work and living environments. These studies should collect information actively with approaches suited to vulnerable populations and schedules appropriate to illnesses and chronic conditions as well as traumatic injuries. Both the design of these studies and evaluation of existing data should include explicit consideration of filter effects.

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FIGURE 1 —Simplified flowchart of events necessary to the documentation of work-related injuries and illnesses.

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